60,130-1357
01MRA0039

IN THE SPECIFICATION:

Please amend the specification as follows:

[2] Window glass lifting mechanisms are most frequently driven by electric motors. It can happen that an object or person's hand gets accidentally placed in the path of the rising window and gets trapped between the top of the window and the vehicle door frame, which can give rise to various types of damage or injury. Various devices are known for stopping ~~the movement of~~ or lowering the window ~~or for causing it to be lowered again~~ if this occurs.

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[3] ~~Thus,~~ United States Patent 5,296,658 uses window seals containing capacitors or optical ~~fibres~~ fibers. The seal characteristics are modified when an object gets trapped, ~~which supplies~~ causing the seal to supply an entrapment signal that operates on the window drive. However, such seals are, firstly, expensive and secondly, have little aesthetic appeal as they are bulky and plainly visible.

[4] United States Patent 6,086,177, German Patents 3,034,114 and 4,442,171 disclose ~~information measures concerning~~ measurement devices that monitor the drive motor for to detect~~ing~~ entrapment. German pPatent 3,034,114 proposes measuring the speed of rotation of the electric motor, German Patent 4,442,171 proposes measuring electric motor current and United States Patent 6,086,177 proposes measuring another motor characteristic. Some change in the measured information makes it possible to determine than an object is trapped. However, such methods have disadvantages. In view of the characteristics of the electric motor, notably its inertia, resistance or flux, a fairly high response time between ~~an~~ the trapping of an object ~~getting entrapped~~ and its detection exists. Response time is typically ~~of~~ on the order of 25 ms. The window glass drive force can in the meantime substantially increase and lead to injury. The entrapment force can also exceed the threshold values defined in the relevant standards, which makes it difficult to get vehicle roadworthiness approval.

[42] The invention proposes measuring, without phase shift, a mechanical tension of a window lifting mechanism part, represented by the tension exercised on a window drive cable.

[43] Figure 1 shows a window lifting mechanism 1 in a first embodiment of the invention. This window lifting mechanism 1 is preferably located inside a vehicle door. The window lifting mechanism has a cable 2 connected to a window glass, (not shown), via a slide member. The slide member is arranged between an upper direction-changing pulley 4 and a lower direction-changing pulley 5. The cable passes over the direction changing pulleys 4 and 5 and makes a loop by passing over the drive pulley 6 of a motor 7, which is not illustrated in detail. Two fixed end stops 8, 9 are located on the path of cable 2, between motor 7 and the upper direction-changing pulley 4. Cable 2 is surrounded by a sheath 10 between the stop members 8 and 9. Sheath 10 has a first end in contact with the first stop member 8. A sensor 11, ~~for example~~ such as a pressure sensor, is inserted between the second end of the sheath 10 and the second stop member 9. The sheath 10 keeps the cable 2 in a curved position.

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[44] Preferably, a slide member 12 is used for connecting the window glass to the cable. The slide member is, for example, secured by crimping on drive cable 2. When the slide member 12 is secured to cable 2, this transmits a drive force for lowering and raising the window glass. The slide member 12 is secured to the window glass by any suitable means, ~~for example by~~ such as bonding or screwing. The securing of slide member 12 on the window glass makes it possible to transmit a drive force for lowering and raising the window.

[46] ~~Below~~In the explanation below, ~~we shall call~~ the upper cable run ~~that~~ is part of the cable 2 that starts from motor 7 and drives the window glass when it is being raised. The cable run is designed to drive the glass during its raising movement. This cable run passes over an upper direction-changing pulley 4. This pulley 4 acts as a point of support for modifying the path of this run of cable 2. Thus, even if the upper cable run originates from a location lower down on the door, the path is redirected so as to drive the window glass upwards. This pulley 4 is pivotally mounted with respect to the vehicle, so as to

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limit friction between the cable 2 and the pulley 4. This reduces cable wear. Pulley 4 is preferably mounted on a structural component 14 secured to the vehicle door. Guide rail 13 can also be provided in this structural part 14.

[48] A sheath 10 surrounds the major portion of the upper cable run between the stop members 8 and 9. The stop members 8, 9 allow a maintaining force to be ~~exercised~~ applied directly or indirectly on the ends of sheath 10. Sheath 10 ~~exercises~~ applies a force having a bending effect on the upper cable run. Thus, when the upper cable run is under tension, this upper cable run sets up a reaction force in sheath 10. A non-compressible sheath is preferably employed. Forces in the sheath 10 and, notably, the axial compression of sheath 10 are now representative of the tension in cable 2. It is possible to keep the sheath 10 in a curved position by, for example, using a sheath 10 which is longer than the distance between the stop members 8 and 9. It is then preferable to employ a flexible sheath, ~~so as~~ to be able to establish curvature of the cable 2. This curvature is then also variable as a function of the tension exercised on the cable.

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[50] In one embodiment, a spring 16 is inserted between pressure sensor 11 and stop member 9. This spring 16 can also be inserted between pressure sensor 11 and the second end of the sheath 10. This spring 16 has the effect of taking up slack in the sheath 10. The sheath 10 transmits this force to the upper run of cable 2. Thus, the cable 2 is kept at a tension higher than a determined threshold level during operation of the window lifting mechanism. This avoids ~~jerks~~ jerking when the window glass is being raised or when ~~changing~~ it is changed over from lowering ~~it~~ to raising ~~it~~. It is preferable to use a compression spring dimensioned so that the turns come into contact during a stabilized raising operation of the window glass.

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[53] Figure 3 shows another embodiment of a window lifting mechanism according to the invention. One end stop 21 for rising travel of a window glass is secured onto cable 2, ~~for example~~ by crimping or any other securing method. One can, for example, use a cable end as the stop member 21 for raising travel of the window glass. A sensor 11, ~~for example~~ such as a pressure sensor, is located above end stop 21. A securing member for

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the window glass, ~~for example~~ such as a slide member 12, is slidably mounted with respect to the cable and comes into abutment with pressure sensor 11. During rising travel of the window glass, sensor 11 gets compressed between the rising travel end stop 21 and the part secured to the window glass. Sensor 11 thus allows the drive force in the cable to be determined. It can also be arranged to provide an end stop for lowering travel 22 on the cable 2 driving the part secured to the window glass.

[58] In an alternative embodiment shown ~~at~~ in Figure 5, sensor 24 is obtained by using a linear potentiometer. An actuator 27 actuates a pushbutton 30. One can use an actuator 27 with a structure similar to that used in Figure 4. The deflection of the pushbutton is in that case proportional to the deflection of spring 16. The linear potentiometer 24 can thus provide a signal whose amplitude is almost proportional to the distance between the end of the sheath 23 and the corresponding end stop. The cable tension can thus be derived from the linear potentiometer used as a position sensor.

[61] Signals output from the sensor can be delivered to processing module 15. This processing module receives the signals at an input connected to the sensor. This processing module may include a comparator which compares the signal measured by the sensor which, for example, represents tension in the cable with a predetermined threshold value as illustrated in Figure 7. When a signal measured G exceeds threshold value S, the processing module concludes that an object is trapped and prevents the window from rising further. The processing module can now send a corresponding signal to a central computer or act directly on the drive motor. Processing module 15 can, for example, be directly connected to a switch on a motor to stop lifting or lowering of a window glass. As tension is measured on a mechanical part having no or extremely reduced phase shift due to processing by module 15, the measurement performed at any given instant corresponds approximately to the force exercised on the upper cable run at that instant.

[62] According to the invention, another method of operation of a processing module allows ~~account to be taken of~~ the window glass position to be taken into account for determining entrapment. Reference measurement values corresponding to given positions

of the window glass are for example stored in memory. These values correspond to thresholds for determining entrapment. The signal measured by the sensor is sampled for corresponding positions of the window glass. The sampling step can, for example, be 2 mm. This step can also be variable depending on window glass position. One can, for example, use a smaller sampling step for the final travel of the window glass. One can simultaneously measure the position of a window glass by, for example, measuring the position ~~on~~ of the electric motor or ~~on~~ a window glass slide member. For each position, the value measured when the window glass is being raised is compared with a corresponding reference entrapment threshold. When the value measured exceeds this threshold, the processing module concludes that an object is trapped and stops the window being raised. It is also possible to sample the measured values as a function of time. Here, at given time intervals, a value measured when the window glass is being raised is compared with a corresponding entrapment reference threshold.

[63] In one embodiment, ~~account is taken of~~ previous window glass lifting cycles are taken into account for setting an entrapment threshold. One can thus use a memory that can be rewritten for storing values measured over one or several previous cycles at determined positions. During a window glass lifting cycle, the measured signals are compared with the corresponding stored values after adding a margin for error to the stored values. One can for example employ the following inequality for determining trapping:

[67] It is clearly possible to store in memory the value for a signal measured during a cycle, incremented by the error margin. This method allows account to be taken of ~~ageing~~ aging of the window lifting mechanism components. This helps avoid undesired shutting down of the window lifting mechanism due to erroneous entrapment detections.

[68] In one embodiment, several measurements for earlier cycles are stored in memory. A threshold is then determined by applying weighting factors to the measured values over the cycles. One can, for example, use the following equation for determining a threshold:

[71] Thus, several cycles are taken into account when determining the threshold. The influence of an earlier cycle performed under particular conditions, such as a very low temperature, consequently has less influence on entrapment threshold determination.

A10 [72] Obviously, the present invention is not limited to the examples and embodiments described and illustrated but may be subject to numerous variations available to those skilled in the art. One can thus also provide means for measuring forces on the drive cable when the window glass is being lowered~~, for avoiding~~ to avoid, for example, an object getting trapped between a door seal and the window glass. The location of the sensor is also not limited to those locations described. It is also possible to provide a force-detecting sensor on another element of the window lifting mechanism, for example on a direction changing pulley, for determining the cable drive tension.